Preliminary Data Sheet No. PD60140-K

International IOR Rectifier

IR53H(D)420

SELF-OSCILLATING HALF BRIDGE

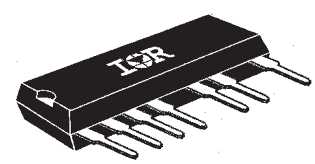
Features

- Output power MOSFETs in half-bridge configuration
- High side gate drive designed for bootstrap operation
- Bootstrap diode integrated into package (HD type)
- Tighter initial deadtime control
- Low temperature coefficient deadtime
- 15.6V zener clamped Vcc for offline operation
- Half-bridge output is out of phase with R_T
- True micropower startup
- Shutdown feature (1/6th V_{CC}) on C_T lead
- Increased undervoltage lockout hysteresis (1Volt)
- Lower power level-shifting circuit
- Lower di/dt gate drive for better noise immunity
- Excellent latch immunity on all inputs and outputs
- ESD protection on all leads
- Constant V_O pulse width at startup
- Heatsink package version (P2 type)

Product Summary

V_{IN} (max)	500V
Duty Cycle	50%
Deadtime (type.)	1.2µs
$R_{ds(on)}$	3.0Ω
P_D (T_A = 25°C)	2.0W or 3.0W

Package

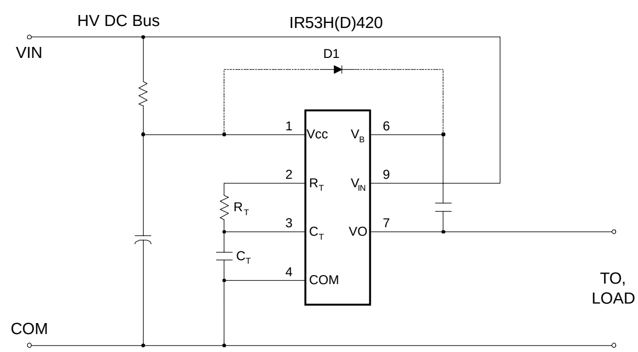


7-Lead SIP

Description

The IR53H(D)420 are complete high voltage, high speed, self-oscillating half-bridge circuits. Proprietary HVIC and latch immune CMOS technologies, along with the HEXFET® power MOSFET technology, enable ruggedized single package construction. The front-end features a programmable oscillator which functions similar to the CMOS 555 timer. The supply to the control circuit has a zener clamp to simplify offline operation. The output features two HEXFETs in a half-bridge configuration with an internally set deadtime designed for minimum cross-conduction in the half-bridge. Propagation delays for the high and low side power MOSFETs are matched to simplify use in 50% duty cycle applications. The device can operate up to the V_{IN} (max) rating.

Typical Connection



External
Fast recovery diode D1 is not required for HD type

Absolute Maximum Ratings

Absolute maximum ratings indicate sustained limits beyond which damage to the device may occur. All voltage parameters are absolute voltages referenced to COM, unless stated otherwise. All currents are defined positive into any lead. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions.

Symbol	Definition		Minimum	Maximum	Units
V_{IN}	High voltage supply		- 0.3	500	V
V_B	High side floating supply		V_O - 0.3	V_O + 25	
V_O	Half-bridge output		-0.3	V_{IN} + 0.3	
V_{RT}	R_T voltage		- 0.3	V_{cc} + 0.3	
V_{CT}	C_T voltage		- 0.3	V_{cc} + 0.3	
I_{CC}	Supply current (note 1)		—	25	mA
I_{RT}	R_T output current		- 5	5	
dV/dt	Peak diode recovery		—	3.50	V/ns
P_D	Package power dissipation @ $T_A \leq +25°C$		—	2	W
		-P2	—	3	
Rth_{JA}	Thermal resistance, junction to ambient		—	60	$^oC/W$
		-P2	—	40	
Rth_{JC}	Thermal resistance, junction to case (heatsink)	-P2	—	20	
T_J	Junction temperature		-55	150	°C
T_S	Storage temperature		-55	150	
T_L	Lead temperature (soldering, 10 seconds)		—	300	

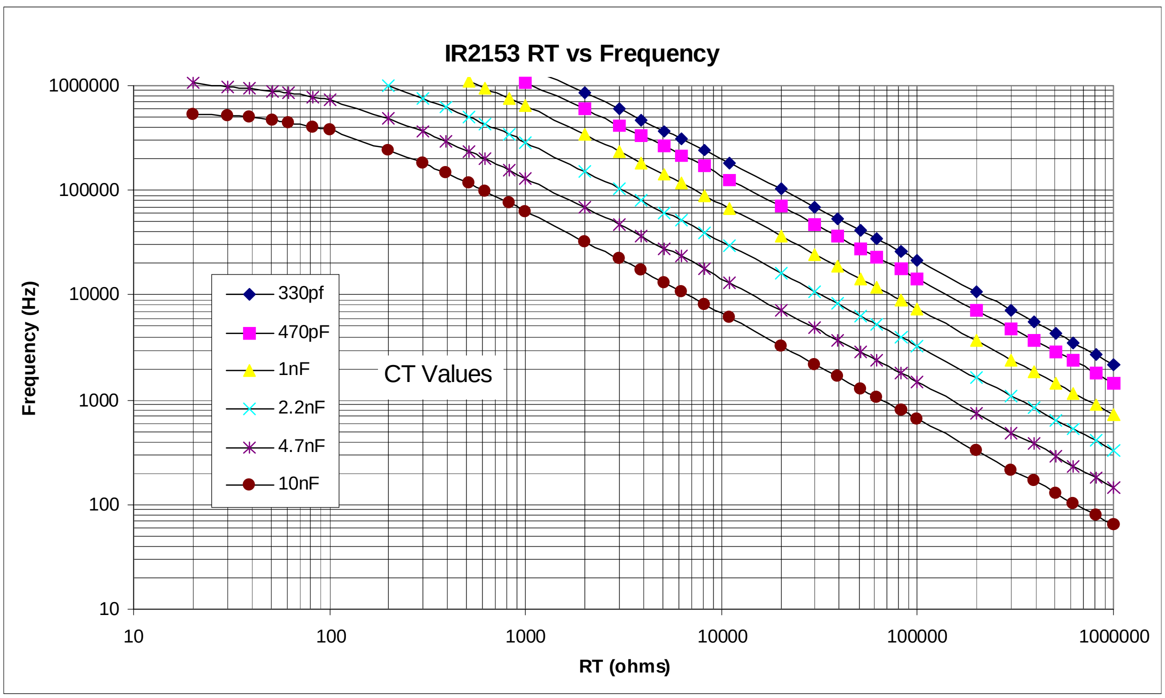
NOTE 1:

This IC contains a zener clamp structure between V_{CC} and COM which has a nominal breakdown voltage of 15.6V. Please note that this supply pin should not be driven by a DC, low impedance power source greater than the V_{CLAMP} specified in the Electrical Characteristics Section

Recommended Component Values

Symbol	Definition	Minimum	Maximum	Units
R_T	Timing resistor value	10	—	kΩ
C_T	C_T pin capacitor value	330	—	pF

IR53H(D)420 RT vs Frequency



Recommended Operating Conditions

The input/output logic timing diagram is shown in figure 1. For proper operation, the device should be used within the recommended conditions.

Symbol	Definition		Minimum	Maximum	Units
V_B	High side floating supply absolute voltage		V_O + 10	$V_O + V_{clamp}$	V
V_{IN}	High voltage supply		—	500	
V_O	Half-bridge output voltage		-3.0 (note 3)	500	
I_D	Continuous drain current	(T_A = 25°C)	—	0.7	A
		-P2	—	0.85	
		(T_A = 85°C)	—	0.5	
		-P2	—	0.6	
		(T_C = 25°C) -P2	—	1.2	
I_{CC}	Supply current		(note 3)	5	mA
T_A	Ambient temperature		-40	125	°C

NOTE 2:

Care should be taken to avoid switching conditions where the V_S node flies inductively below ground by more than 5V.

NOTE 3:

Enough current should be supplied to the V_{CC} lead of the IC to keep the internal 15.6V zener diode clamping the voltage at this lead.

Electrical Characteristics

V_{BIAS} (V_{CC}, V_{BS}) = 12V, C_T = 1 nF and T_A = 25°C unless otherwise specified. The V_{IN}, V_{TH} and I_{IN} parameters are referenced to COM.

MOSFET Characteristics

Symbol	Definition	Min.	Typ.	Max.	Units	Test Conditions	
t_{rr}	Reverse recovery time (MOSFET body diode)	—	240	—		I_F=700mA	di/dt = 100 A/µs
Q_{rr}	Reverse recovery charge (MOSFET body diode)	—	0.5	—	µC		
$R_{ds(on)}$	Static drain-to-source on resistance	—	3.0	—	Ω		
V_{SD}	Diode forward voltage	—	0.8	—	V		

Dynamic Characteristics

Symbol	Definition	Min.	Typ.	Max.	Units	Test Conditions
D	RT duty cycle	—	50	—	%	fosc = 20 kHz
tsd	Shutdown propagation delay	—	660	—	nsec	

Electrical Characteristics

V_{BIAS} (V_{CC}, V_{BS}) = 12V, C_T = 1 nF and T_A = 25°C unless otherwise specified. The V_{IN}, V_{TH} and I_{IN} parameters are referenced to COM.

Low Voltage Supply Characteristics

Symbol	Definition	Min.	Typ.	Max.	Units	Test Conditions
V_{CCUV+}	Rising V_{CC} undervoltage lockout threshold	8.1	9.0	9.9	V	
V_{CCUV-}	Falling V_{CC} undervoltage lockout threshold	7.2	8.0	8.8		
V_{CCUVH}	V_{CC} undervoltage lockout Hysteresis	0.5	1.0	1.5		
I_{QCCUV}	Micropower startup V_{CC} supply current	—	75	150	µA	$V_{CC} \le V_{CCUV-}$
I_{QCC}	Quiescent V_{CC} supply current	—	500	950		
V_{CLAMP}	V_{CC} zener clamp voltage	14.4	15.6	16.8	V	I_{CC} = 5mA

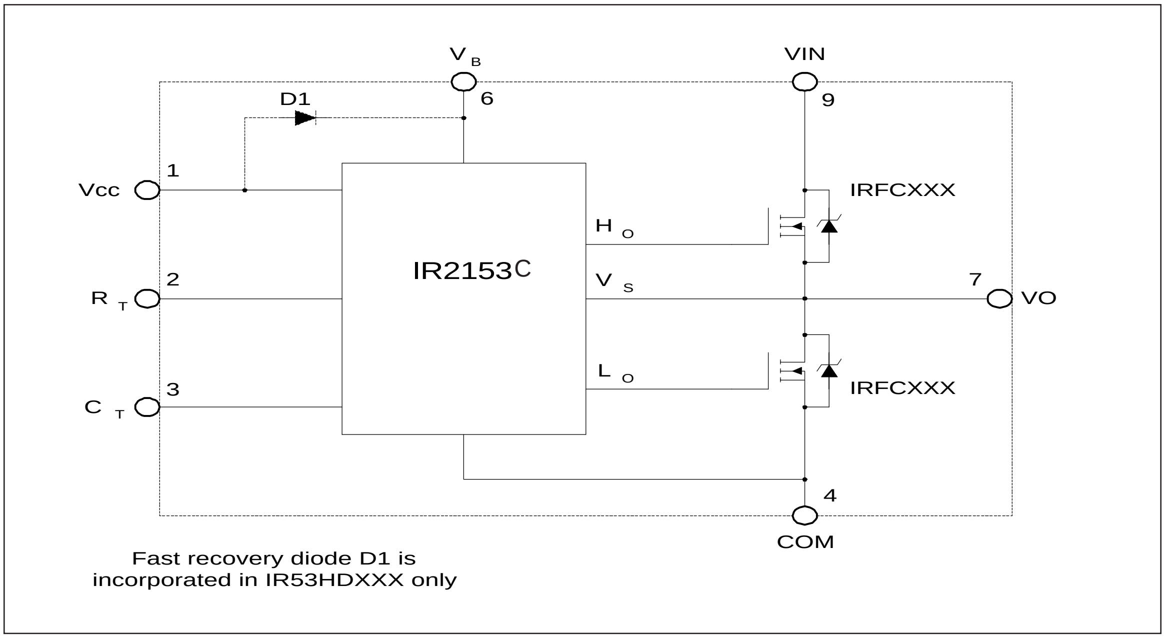
Floating Supply Characteristics

Symbol	Definition	Min.	Typ.	Max.	Units	Test Conditions
I_{QBSUV}	Micropower startup V_{BS} supply current	—	0	10	µA	$V_{CC} \le V_{CCUV-}$
I_{QBS}	Quiescent VBS supply current	—	30	50		
V_{BSMIN}	Minimum required V_{BS} voltage for proper functionality from R_T to HO	—	4.0	5.0	V	V_{CC}=V_{CCUV+} + 0.1V
I_{OS}	Offset supply leakage current	—	—	50	µA	V_B = V_S = 600V
V_F	Bootstrap diode forward voltage (IR2153D)	0.5	—	1.0	V	I_F = 250mA

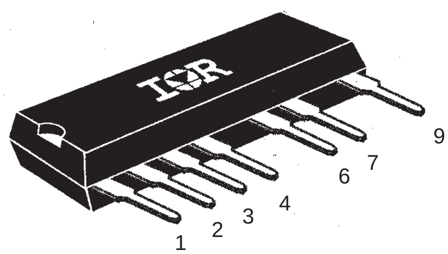
Oscillator I/O Characteristics

Symbol	Definition	Min.	Typ.	Max.	Units	Test Conditions
f_{OSC}	Oscillator frequency	19.4	20	20.6	kHz	R_T = 36.9kΩ
		94	100	106		R_T = 7.43kΩ
d	R_T pin duty cycle	48	50	52	%	fo < 100kHz
I_{CT}	C_T pin current	—	0.001	1.0	uA	
I_{CTUV}	UV-mode C_T pin pulldown current	0.30	0.70	1.2	mA	V_{CC} = 7V
V_{CT+}	Upper C_T ramp voltage threshold	—	8.0	—	V	
V_{CT-}	Lower C_T ramp voltage threshold	—	4.0	—		
V_{CTSD}	C_T voltage shutdown threshold	1.8	2.1	2.4		
V_{RT+}	High-level R_T output voltage, V_{CC} - V_{RT}	—	10	50	mV	I_{RT} = 100µA
		—	100	300		I_{RT} = 1mA
V_{RT-}	Low-level R_T output voltage	—	10	50		I_{RT} = 100µA
		—	100	300		I_{RT} = 1mA
V_{RTUV}	UV-mode R_T output voltage	—	0	100		$V_{CC} \le V_{CCUV-}$
V_{RTSD}	SD-Mode R_T output voltage, V_{CC} - V_{RT}	—	10	50		I_{RT} = 100µA, V_{CT} = 0V
		—	10	300		I_{RT} = 1mA, V_{CT} = 0V

Functional Block Diagram



Lead Assignments



1	V_{CC}	6	V_B
2	R_T	7	VO
3	C_T	9	V_{IN}
4	COM		

9 Lead SIP without Leads 5 and 8

Lead Definitions

Symbol	Lead Description
V_{CC}	Logic and internal gate drive supply voltage.
R_T	Oscillator timing resistor output
C_T	Oscillator timing capacitor input
V_B	High side gate drive floating supply.
V_{IN}	High voltage supply
VO	Half Bridge output
COM	Logic and low side of half bridge return

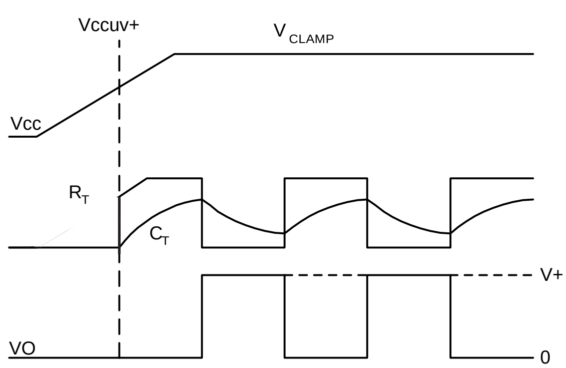
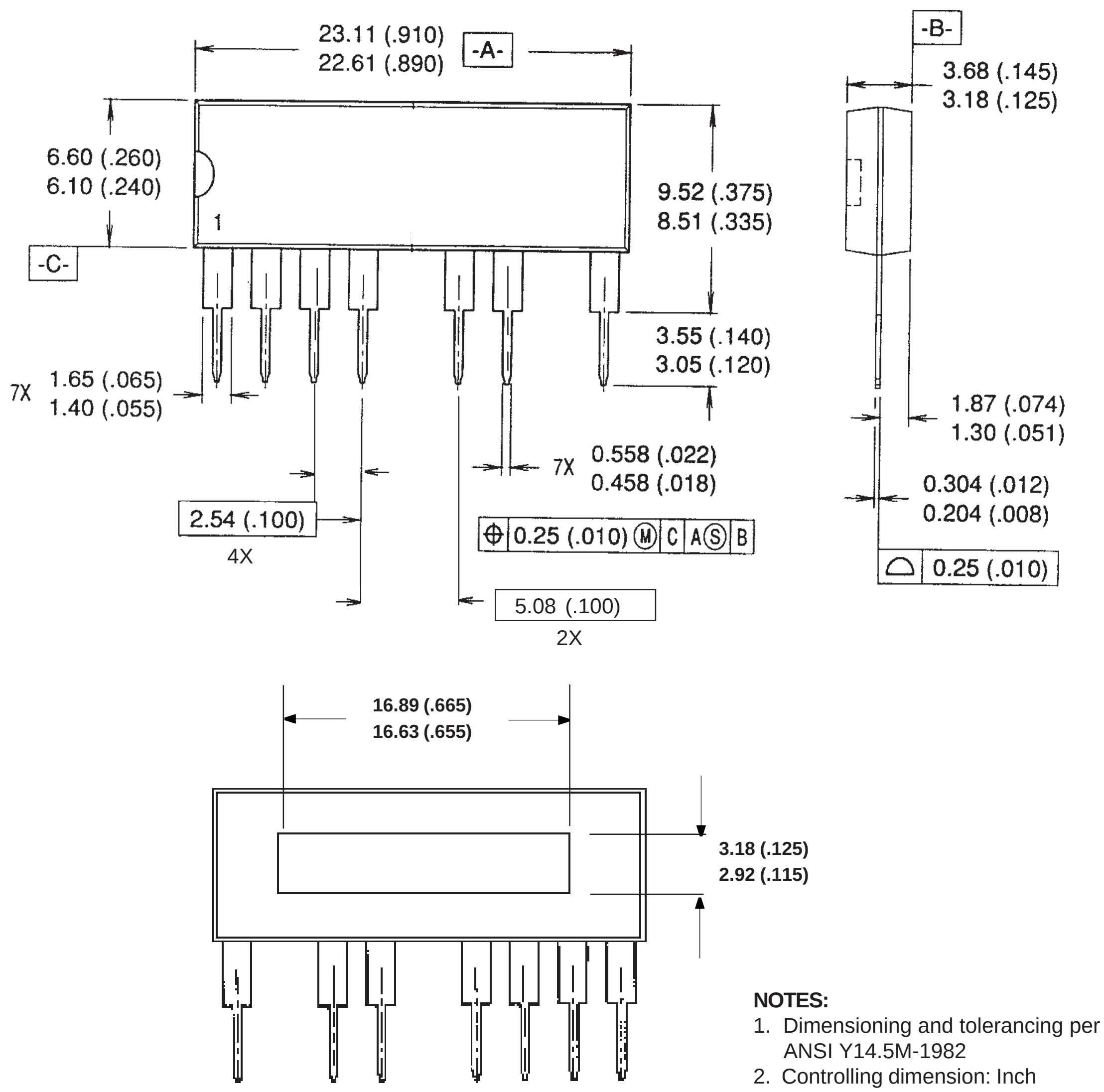


Figure 1. Input/Output Timing Diagram

Case Outline - 7 pin



NOTES:
1. Dimensioning and tolerancing per ANSI Y14.5M-1982
2. Controlling dimension: Inch
3. Dimensions are shown in millimeters (inches)

WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245 Tel: (310) 252-7105